UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION REPORT

Docket No. 71-3036
Model No. JRF-90Y-950K
Japanese Certificate of Competent Authority No.
J/2043/B(U)F-96

Enclosure 1

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SUMMARY

By letter dated January 5, 2023 (DOT, 2023a), as supplemented on March 2, 2023 (DOT, 2023b), and May 11, 2023 (DOT, 2023c), requesting the U.S. Nuclear Regulatory Commission (NRC) assistance in evaluating the Model No. JRF-90Y-950K package (JRF-90Y-950K thereafter) as authorized by the Japanese Certificate of Competent Authority No. J/2043/B(U)F-96 issued on May 23, 2022 (DOT, 2023b), and making a recommendation concerning the revalidation of the package for import and export use. Specifically, the U.S. Department of Transportation (DOT) requested NRC review changes such as:

1) the removal of several fuel element types from transportation using this package.

2) The update to aging evaluations in the JRF-90Y-950K Safety Analysis Report (SAR) considering a 60-year service life from a prior 40-year service life.

The applicant requested U.S. revalidation of the certificate for the JRF-90Y-950K package to the requirements of International Atomic Energy Agency (IAEA) Specific Safety Requirements No. 6 (SSR-6), "Regulations for the Safe Transport of Radioactive Material," 2018 Edition (IAEA, 2018). The NRC staff (the staff thereafter) previously revalidated the certificate for this package per the 2012 Edition of the IAEA SSR-6 (IAEA, 2012). The staff reviewed the application, as supplemented, against the requirements of IAEA SSR-6, 2018 Edition (IAEA, 2018).

The table below includes information related to some of the NRC's previous reviews of the Model No. JRF-90Y-950K package.

Japanese Certificate of Competent Authority No.	Date of Revalidation Recommendation Issuance	NRC Safety Evaluation Report (SER)
J/2039/B(U)F	April 1, 2022	NRC, 2022a
J/170/B(U)F-96	April 24, 2022	NRC, 2022b
J/119/B(U)F-96	August 31, 2010	NRC, 2010
J/119/B(U)F-85	January 29, 1999	NRC, 1999

Even though the Japanese Certificate of Competent Authority Nos. are different, they correspond to the JRF-90Y-950K package design evaluated in this report (i.e., J/2043/B(U)F-96).

Based on our review of the statements and representations contained in the application, and for the reasons stated below, the staff recommends revalidation of Japanese Certificate of Competent Authority J/2043/B(U)F-96 issued on May 23, 2022, for the Model No. JRF-90Y-950K transport package with no additional conditions.

1.0 GENERAL INFORMATION

The JRF-90Y-950K is a Type B fissile package designed for the transport of research reactor fuel and other experimental components containing fissile material. In this section of the SER, the staff focused their review on verifying that the proposed changes to the certificate met the requirements in Paragraph 838 of the IAEA SSR-6 (IAEA, 2018). Additional changes to the application such as the aging management program and other technical information are evaluated in other sections of this SER.

1.1 Packaging

The packaging consists of the main body and basket. The applicant did not propose changes to the packaging design for the JRF-90Y-950K.

1.2 Contents

As described in the document including the summary of changes (DOT, 2023b) related to this review, the applicant requested the removal of the following authorized contents:

a) JRR-4B Type Fuel Element (HEU fuel)

b) JRR-4L Type Fuel Element (LEU fuel)

c) JRR-4 Fuel Element (LEU fuel)

d) JMTRC Standard Fuel Element (HEU Fuel) - Type A, B, C

e) JMTRC Standard Fuel Element (HEU Fuel) - Pin Fixing Type B, C

f) JMTRC Special Fuel Element (HEU Fuel) - Special Type B

g) JMTRC Special Fuel Element (HEU Fuel) - Special Type C, D

h) JMTRC Fuel Follower (HEU Fuel)

The applicant is requesting removing these contents because there are no plans for shipping these materials in the future.

1.3 Evaluation Findings

Based on review of the statements and representations related to the changes to the Japanese Certificate of Competent Authority No. J/2043/B(U)F-96, Model No. JRF-90Y-950K package design, described in the application (DOT, 2023a and b) and as discussed in this SER section, the staff has reasonable assurance that the package meets the requirements in Paragraph 838 (a) – (g), (i) - (m) and (s) - (x) of the IAEA SSR-6 (IAEA, 2018).

2.0 STRUCTURAL EVALUATION

The purpose of the structural evaluation is to verify that the structural performance of the package meets the regulatory requirements of IAEA SSR-6 (IAEA, 2018). This section of the

SER documents the staff's reviews, evaluations, and conclusions with respect to the structural integrity of the JRF-90Y-950K transportation package with the proposed changes.

A summary of the staff's structural evaluation is provided below.

2.1 Description of the Amendment affecting the Structural Design

In the current amendment to the JRF-90Y-950K package, the applicant removed several fuel element types from transportation using this package. In addition, the applicant updated the aging evaluations in the JRF-90Y-950K SAR considering a 60-year service life from a prior 40-year service life (NRC, 2022a).

For this structural review, since the first part of the changes (i.e., the removal of several fuel elements) did not place any additional demands on the structural components, the structural performance remain unaffected for this portion of the amendment. The staff review is focused on evaluating aging effects on the affected package components with the increase in the service life from 40 to 60 years. The other associated components of the package remain unchanged.

2.2 Structural Evaluation of the Amendment

2.2.1 Contents excluded from the package of this SER

As described in Section 1.0 of this SER, the applicant proposed removing authorized content from this package (see Section 1.2, "Contents," of this SER). The staff finds that with the deletion of these fuel elements and associated changes to the SAR figures, text, and tables, did not impact the previous structural evaluation of components of the package.

2.2.2 Aging Mechanism – Fatigue and Corrosion

The applicant addressed the requirements of Paragraphs 613A and 809(f) of the IAEA SSR-6, 2018 Edition, in Section (II)-F, "Consideration of Aging of Nuclear Fuel Package," of the SAR (DOT, 2023b). The following documents the staff's review and evaluation with respect to the structural integrity of the package components affected by aging factors such as fatigue and corrosion. Section 7.0, "Materials Evaluation," of this SER includes the evaluation of the package materials as it relates to aging effects.

2.2.2.1 Fatigue

The applicant evaluated one of the aging factors (fatigue) in more detail in Section (II) A.4.4, "Hoisting accessory," and A.5.1.4, "Comparison of allowable stress," of the SAR (DOT, 2023b). The stainless steel lifting plates and the inner shell are subject to repetitive loads through the expected service life due to handling of the package and from differential pressure loads, respectively.

A. Lifting plates

For the fatigue evaluation of the lifting plates, the applicant has estimated 18,000 (1.8×10^4) loading cycles over the 60-year service life proposed in the application, considering 3 shipments (transports) per year and 100 lifts per shipment as stated in Sections (II).A.4.4 and (II) Table F.2, "Evaluation of necessity of considering aging in safety analysis (1/4)," of the SAR. The applicant has shown that the maximum cyclic stress (10.8 Newton per square millimeters (N/mm^2)) in the plate is much lower than the fatigue strength (380 N/mm^2) associated with the 1.8×10^4 estimated loading cycles based on the established design fatigue curve in Section (II) – Figure A.6, “Design Fatigue Curve…," of the SAR for the austenitic type of stainless steel material.

The staff finds this evaluation acceptable and notes that the referenced design fatigue curve in the SAR is similar to Figure I-9.2M, “Design Fatigue Curves for Austenitic Steels,” per the 2010 or later American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (BPV) Code, Section III, Division 1, Mandatory Appendix I.

B. Inner shell components

For the fatigue evaluation of the inner shell components (i.e., inner shell body, inner shell lid, and the connecting bolts) due to repetitive pressure loads, the applicant estimated the loading cycles based on the 60-year life and 3 shipments per year. However, the applicant has considered 500 loading cycles in the fatigue evaluation presented in Sections (II).A.5.1.4 and (II)-Table F.2, “Evaluation of necessity of considering aging in safety analysis (1/4),” of the SAR (DOT, 2023b). For the inner shell components, the applicant has shown that the number of loading cycles considered over the lifetime is much lower than the allowable number of loading cycles based on the maximum cyclic stress in the component material and the applicable established design fatigue curve in the SAR for the inner shell components material. In particular, for the most critical component, the clamping bolts, the applicant has shown that the considered number of loading cycles (500) over the lifetime is lower than the allowable number of loading cycles based on the maximum cyclic stress in the bolt material and the established design fatigue curve Section (II) Figure A.7, “Design fatigue curve (high tensile strength bolt),” of the SAR. Therefore, there is no impact to the structural adequacy of the inner shell due to repetitive differential pressure loads.

The staff finds this evaluation acceptable and notes that the referenced design fatigue curve in the SAR is similar to Figure I-9.4M, “Design Fatigue Curve for High Strength Steel Bolting,” per the 2010 or later ASME BPV Code, Section III, Division 1, Mandatory Appendix I.

2.2.2.2 Corrosion

As part of the aging evaluation for one of the aging factors’ (e.g., chemical action) that effects exposed stainless steel material, the applicant indicated in Section (II)-Table F.2 of the SAR (DOT, 2023b) that stainless steel is a corrosion-resistant material, and corrosion effects due to adherence of sea salt particles is not expected during transportation. Further, the applicant has estimated 0.06 mm total reduction in the thickness of the outer vessel exterior plate due to corrosion at the rate of 0.001 mm maximum reduction per year over the 60-year life and presented the structural evaluation in Section (II)-Table F.2 of the SAR. Considering the combined reduction (0.26 mm) in the material thickness due to the corrosion over the 60-year life and the manufacturing tolerance, the applicant has shown an acceptable margin ratio in Section (II)-A.5.5, “Penetration,” the SAR for the outer vessel exterior plate, This margin ratio is reduced under the penetration test, which is positive, so there is no impact to the structural adequacy due to predicted corrosion during the lifetime. In addition, even if corrosion occurs, the periodic inspections and the maintenance activities will identify its presence, and remedial measures will be taken as appropriate to repair or replace the affected component during the lifetime. The staff finds the evaluation provided by the applicant acceptable.

2.2.3 Structural Evaluation under the RCT, NCT, and ACT

The evaluations previously reviewed by the staff for the other RCT, NCT, and ACT are bounding or remain unaffected by the changes described above for this request.

2.3 Evaluation Findings

Based on the staff's review of the structural evaluation and related sections of the application, the staff finds with reasonable assurance that the JRF-90Y-950K package with the revised aging considerations and deletion of several of the previously approved contents from the package has adequate structural capacity to meet the requirements of IAEA SSR-6 (IAEA, 2018).

3.0 THERMAL EVALUATION

The purpose of the thermal evaluation is to demonstrate that the package meets the thermal performance requirements when evaluated for normal and accident conditions of transport as defined in the IAEA SSR-6 (IAEA, 2018). The JRF-90Y-950K package was originally issued a DOT certificate, with the requisite review and approval by NRC, on January 29, 1999 (NRC, 1999). In that application, the applicant evaluated the thermal response of the package through prototype testing and analytical evaluation.

Requested changes include the removal of certain contents from the Certificate (see Section 1.0 of this SER) and the addition of considerations for ageing of the JRF-90Y-950K package in accordance with the requirements of the latest version of IAEA SSR-6 (IAEA, 2018). The requested changes do not have any impacts on the current thermal performance of the package.

3.1 Normal Conditions of Transport

The removal of certain contents from the package's certificate, as requested by the applicant, will have no effect on the thermal performance of the package and continues to be bounded under NCT. Therefore, the package meets the requirements of IAEA SSR-6 (IAEA, 2018).

3.2 Accident Conditions of Transport

The thermal performance of the JRF-90Y-950K package with the requested contents removed, will have no effect on the thermal performance of the package and continues to be bounded under ACT. Therefore, the package meets the requirements of IAEA SSR-6 (IAEA, 2018).

3.3 Evaluation Findings

Based on the staff's review of the thermal and related sections of the application, the staff finds, with reasonable assurance, that the JRF-90Y-950K package meets the thermal standards of IAEA SSR-6 (IAEA, 2018) for both normal and accident conditions of transport.

4.0 CONTAINMENT EVALUATION

The purpose of the containment evaluation is to demonstrate that the JRF-90Y-950K package meets the containment performance requirements of the IAEA transport regulations found in IAEA SSR-6 (IAEA, 2018), when evaluated for normal and accident conditions of transport as defined in the IAEA regulations.

The JRF-90Y-950K package was originally issued a DOT certificate, with the requisite review and approval by NRC, on January 29, 1999 (NRC, 1999). In that application, the applicant evaluated the performance of the package through prototype testing and analytical evaluation. The package was subsequently revalidated by NRC on August 31, 2010 (NRC, 2010), and April 24, 2022 (NRC, 2022b).

The applicant, by letter dated July 29, 2022, requested a certificate from DOT and DOT subsequently requested a revalidation review from the NRC by a letter dated January 5, 2023 (DOT, 2023a).

Requested changes include the removal of certain contents from the certificate and the addition of considerations for ageing of the JRF-90Y-950K package in accordance with the requirements of the latest version of IAEA SSR-6 (IAEA, 2018). The requested changes do not have any impacts on the containment performance of the package.

4.1 Containment Boundary

There have been no changes to the containment boundary of the package. Therefore, the staff's findings in previous safety evaluations are still valid.

4.2 Evaluation Findings

Based on the staff's review of the containment and other related sections of the application, the staff finds, with reasonable assurance, that the JRF-90Y-950K package meets the containment standards of IAEA SSR-6 (2018) for both normal and accident conditions of transport.

5.0 SHIELDING EVALUATION

The staff reviewed the application to ensure that the JRF-90Y-950K provides adequate shielding from the proposed contents and verified that the package met the radiation level requirements within the IAEA SSR-6 (IAEA, 2018) for protecting people and the environment.

The applicant requested U.S. revalidation of the JRF-90Y-950K package to the requirements of the IAEA SSR-6 (IAEA, 2018). The staff previously revalidated the certificate for this package in 2022 (NRC, 2022a and b). As it pertains to the shielding evaluation, the applicant added details with respect to how the applicant determined the source term.

The addition of calculation details to the application does not affect the previous analysis of the source term and dose rates. The applicant retained conservative assumptions from fuel elements that have been removed as allowable contents from the certificate. Specifically, the aluminum-limited content of the JRR-4L fuel assembly, which was selected to limit the effect of self-shielding. Retaining this assumption maintains conservative estimates of the package external dose rates, which remain below the dose rate limits in the IAEA, SSR-6 (IAEA, 2018).

Based on the staff's review of the application (DOT, 2023a and b), including the certificate for the JRF-90Y-950K package as well as the applicant's initial assumptions, model configurations, analyses, and results provided in the application, the staff finds with reasonable assurance that the package, with the requested contents, will meet the radiation dose rate requirements of IAEA SSR-6.

6.0 CRITICALITY SAFETY EVALUATION

The purpose of this review is to ensure that the JRF-90Y-950K meets the criticality safety requirements of within the IAEA SSR-6 (IAEA, 2018) for protecting people and the environment. As it pertains to the criticality safety evaluation, the only significant change is the deletion of previously approved contents as described in Section 1.2 of this SER.

Although the applicant removed contents from the certificate, the criticality analysis within the SAR (DOT, 2023b) is unchanged from the analysis corresponding the revalidation recommendation provided in April 2022 for the JRF-90Y-950K (NRC, 2022b). The applicant modeled each fuel composition and assumed all gaps within the package are filled with water. The applicant also varied the water density to determine optimum moderation. This analysis resulted in a maximum system k_{eff} plus three times the calculation Monte Carlo uncertainty of 0.939, which is below the 0.95 acceptance criteria. The removal of the other previously registered contents does not change the conclusions of this analysis.

Based on the staff's review of the application (DOT, 2023a and b), including the certificate for the JRF-90Y-950K package, as well as the applicant's initial assumptions, model configurations, analyses, and results provided in the application, the staff finds that the applicant has identified the most reactive configuration of the Model No. JRF-90Y-950K package with the requested contents, and that the criticality results are conservative and demonstrate that the package and package arrays wills be subcritical. Therefore, the staff finds with reasonable assurance that the package, with the requested contents, will meet the criticality safety requirements of IAEA SSR-6 (IAEA, 2018).

7.0 MATERIALS EVALUATION

The purpose of the materials evaluation is to verify that the materials performance of the JRF-90Y-950K package meets the regulatory requirements of IAEA SSR-6 (IAEA, 2018). The staff verified compliance with the regulatory updates from the 2012 (IAEA, 2012) to the 2018 (IAEA, 2018) edition of IAEA SSR-6 and any changes impacting the materials evaluation, specifically, related to aging management requirements since the NRC's previous recommendation to revalidate the package.

This section of the SER documents the staff's reviews, evaluations, and conclusions with respect to the material performance of the changes to the JRF-90Y-950K transportation package design.

7.1 Summary of Changes Affecting Materials Review

In the current amendment to the JRF-90Y-950K package, the applicant removed several fuel types from this transportation package as described in Section 1.2 of this SER. In addition, the applicant updated considerations for aging effects in the JRF-90Y-950K SAR considering a 60-year service life from a prior 40-year service life to address requirements of IAEA SSR-6, 2018 Edition (IAEA, 2018).

For this materials review, since the first part of the amendment (i.e., the removal of several fuel elements) did not place any additional demands on the material performance, the material performance remains unaffected by this change of the amendment (DOT, 2023b). The staff review was focused on the findings addressing the effects of aging on the affected package components with the increase in the service life from 40 to 60 years.

7.2 Consideration for Aging

Section (II)-F of the SAR (DOT, 2023 b) provides considerations for aging for this transportation package. Section (II)-Table F.1, "Aging Factors to be Considered," describes the conditions of use and various requirements that must be satisfied for storage, before transportation, and after transportation. While in storage, a periodic self-inspection is performed at least once a year as described in Section (III)-B of the SAR. Before transportation, a pre-shipment inspection is conducted as described in Section (III)-A of the SAR. Each transport period is expected to be 100 days or less. After each transportation, a visual inspection is conducted prior to storage indoors. According to the SAR, the applicant performed aging evaluations assuming that the period of use of each package is 60 years from its fabrication with 3 transports per year and each transport taking 100 days.

Section (II) F.2, "Evaluation of Necessity of Considering Aging and Safety Analysis," the applicant evaluated the effects of aging in the safety analyses during the planned period of use of the package, including heat, radiation, chemical changes, and fatigue. The applicant provided the list of materials used in Section (II)-Table A.5, "Mechanical properties of materials," along with material properties in Section (II)-Table A.6, "Mechanical properties of materials to be used as design standards," and aging considerations and evaluations are performed on stainless steel, heat insulator and shock absorber in Section (II)-Table F.2. SAR specifically excludes O-rings as these are replaced on each shipment. In addition, aging of the package contents is not considered because these are not stored in the transportation package and change with each shipment.

The staff reviewed the applicant's proposed disposition of each of the aging effects by considering the applicant's evaluation of the component's materials, loading conditions, service environments, aging mechanisms, and the potential effects of aging on the component's safety function. The staff also considered the applicant's crediting of its existing maintenance program inspections for condition monitoring to manage applicable aging effects.

7.2.1 Stainless Steel

7.2.1.1 Heat

The applicant notes that the maximum temperature in service under general test conditions with heat due to solar radiation is 65°C and , the stainless steel creep behavior is observed above 425°C. Based on the review of this information, the staff finds that the applicant adequately demonstrated that the stainless steel used in the fabrication of the JRF-90Y-950K, as described in the application, will not undergo any considerable aging effects due to heat that could degrade stainless component functionality under NCT.

7.2.1.2 Radiation

For stainless steel, the applicant noted that a neutron irradiation dose of more than 10^{16} neutrons per square centimeters (n/cm^2) is required to effect material properties. The applicant also noted that if 1 cm^2 of a structural component is intensively irradiated by neutrons, with the assumption that the package will be in use 3 times a year for 60 years with each transportation period of 100 days, the neutron irradiation dose will be far less than the radiation level needed to adversely affect material properties during the lifetime service of the transportation package. Based on its review of this information, the staff finds that the applicant adequately demonstrated that the stainless steel used in the fabrication of the JRF-90Y-950K, as described in the application, will not undergo any significant aging effect due to radiation that could degrade stainless steel component functionality under normal conditions of transport.

7.2.1.3 Chemical Reaction

The applicant provided justification for its assertion that stainless steel corrosion would have a negligible effect on component functionality. Furthermore, should localized corrosion occur, the applicant noted that periodic inspection and maintenance work should identify any presence of corrosion and appropriate measures will be taken. The staff confirmed that stainless steel is not prone to general corrosion. However, in outdoor air environments, localized corrosion mechanisms, such as stress corrosion cracking, pitting, and crevice corrosion could potentially degrade the structural integrity of welded stainless steel components over extended periods of time due to the attack of passive films by chlorides or other chemically aggressive species present in dissolved salts. To address this, the staff confirmed that the periodic visual inspections that are required to be performed as part of the maintenance program are sufficient to ensure that appropriate corrective actions are taken if significant localized corrosion is detected for stainless steel components. Therefore, based on the staff's review of the applicant's periodic visual inspections program and associated maintenance activities, the staff finds, with reasonable assurance, that localized corrosion of stainless steel will be adequately managed during the extended operating term proposed in the application.

7.2.1.4 Fatigue

The applicant considered aging effects due to repeat lifting of the transportation package, this is discussed in structural evaluation section 2.0 of this SER.

7.2.2 Heat Insulator

7.2.2.1 Heat

The applicant referenced a research report that considered the effect of high temperature exposure on the weight loss of heat insulation material. The applicant stated that according to that report, the material used for heat insulation starts losing weight rapidly at temperatures above 200°C. The maximum temperature under general test conditions with heat from solar radiation, as stated in the SAR, is 65°C; accordingly, the applicant determined that this material will not be adversely affected by heat during NCT. The staff confirmed that the details provided by the applicant are sufficient to ensure that the thermal insulating properties of the heat insulation material will not be degraded due to heat exposure over the extended operating term. Therefore, the staff finds that the applicant adequately demonstrated that this material will not undergo any significant aging effects due to heat that could degrade functionality under normal conditions of transport.

7.2.2.2 Radiation

The applicant noted that a neutron irradiation dose of more than 10^{15} n/cm^2 is required to effect material properties of the heat insulation material. The applicant noted that if 1cm^2 of a structural component is intensively irradiated by neutrons with the assumption that the package will be in use three times a year for 60 years with transportation periods of 100 days, the total neutron irradiation dose will be is far less than needed to effect material properties of the heat insulator during the lifetime service of the transportation package. The staff confirmed that the details provided by the applicant are sufficient to ensure that the thermal insulating properties of the heat insulating material will not be degraded due to radiation exposure over the extended operating term. Therefore, the staff finds that the applicant adequately demonstrated that this material will not undergo any significant aging effects due to radiation that could degrade functionality under normal conditions of transport.

7.2.2.3 Chemical Reaction

The applicant noted that this material may absorb some moisture. However, the applicant also stated that the heat insulation material is in a sealed space surrounded by stainless-steel and does not come in contact with outside air, reducing the risk of any prolonged reaction that may cause material degradation. The staff confirmed that the heat insulation material will be adequately protected from the outside air environment provided that it remains sealed inside the stainless steel enclosure.

The staff noted that visual inspection of the stainless steel enclosure as part of routine maintenance may be needed to ensure there is no breach that could allow the intrusion of moisture into the stainless steel enclosure where it could degrade the heat insulation material. The staff confirmed that the information provided by the applicant is sufficient to ensure that the thermal insulating properties of the heat insulation material will not be degraded due to adverse reactions with moisture from outside air, provided that the stainless steel enclosure is not significantly degraded such that it is vulnerable to moisture intrusion. Therefore, the staff finds that the applicant adequately demonstrated that this material will not undergo unacceptable aging due to adverse reaction with moisture that would degrade its functionality under NCT.

7.2.2.4 Fatigue

This heat shielding material is not intended to take any repeated stress from handling that can cause fatigue related degradation under NCT. There was no need to evaluate this material for aging effects due to fatigue. Therefore, the staff finds it acceptable that no evaluation was provided.

7.2.3 Shock Absorber

7.2.3.1 Heat

The applicant noted that this material is affected by temperatures above 100°C. Since the maximum temperature under general test conditions with heat from solar radiation, as stated in the SAR, is 65°C, this material does not degrade due to heat exposure. Therefore, the staff finds that the applicant adequately demonstrated that this material will not undergo any significant aging effect due to heat that could degrade functionality under NCT.

7.2.3.2 Radiation

For the shock absorbing material, the applicant notes that no changes were observed up to a neutron irradiation dose of 3 mega grays (MGy). The applicant estimated that the irradiation dose from loaded package contents, which is far less than needed to effect material properties during the lifetime service of the transportation package. The staff confirmed that the details provided by the applicant are sufficient to ensure that the energy absorbing function of the shock absorbing material would not be adversely affected due to radiation exposure over the extended operating term proposed on the application. Therefore, the staff finds that the applicant adequately demonstrated that this material will not undergo adverse aging due to radiation under NCT.

7.2.3.3 Chemical Reaction

The applicant noted that this material was evaluated on the assumption that it may absorb some moisture. However, the applicant stated that the shock absorbing material is in a sealed space surrounded by stainless steel and does not come in contact with outside air, which reduces the risk of any prolonged reaction that can cause material degradation. The staff confirmed that the shock absorbing wood will be adequately protected from the outside air environment provided that it remains sealed inside the stainless steel enclosure.

The staff notes that visual inspection of the stainless steel enclosure as part of routine maintenance may be needed to ensure there is no breach that could allow the intrusion of moisture into the stainless steel enclosure where it could degrade the shock absorbing material. The staff confirmed that the information provided by the applicant is sufficient to ensure that the shock absorbing function of the material will not be degraded due to adverse reactions with moisture from outside air, provided that the stainless steel enclosure is not significantly degraded, such that it is vulnerable to moisture intrusion. Therefore, the staff finds that the applicant adequately demonstrated that this material will not undergo unacceptable aging due to adverse reaction with moisture that would degrade its functionality under NCT.

7.2.3.4 Fatigue

This shock absorbing material is not intended to take any repeated stress from handling under NCT that can cause fatigue related degradation. Therefore, the staff finds it acceptable that no evaluation was provided.

Based on the details provided in the application, the staff finds that the package meets the requirements for consideration of aging mechanisms per paragraphs 613A and 809F of the IAEA SSR-6 (IAEA, 2018).

7.2 Evaluation Findings

Based on the staff's review of the application including the materials evaluation and maintenance activities related to aging management, the staff concludes that the JRF-90Y-950K package has adequate material performance for the 60-year operating period. Therefore, the staff finds with reasonable assurance that the JRF-90Y-950K package meets the materials requirements of IAEA SSR-6, 2018 Edition (IAEA, 2018).

8.0 QUALITY ASSURANCE

The purpose of the quality assurance (QA) review is to verify that the package design meets the requirements of IAEA SSR-6 (IAEA, 2018). The staff reviewed the description of the QA program for the Model No. JRF-90Y-950K package against the standards in the IAEA SSR-6.

8.1 Evaluation of the Quality Assurance Program

The applicant developed and described a QA program for activities associated with transportation packaging components important to safety. Those activities include design, procurement, fabrication, assembly, testing, modification, maintenance, repair, and use. The applicant's description of the QA program (i.e., management system and compliance assurance programs in IAEA SSR-6, 2018 Edition) meets the requirements of the applicable IAEA SSR-6 (IAEA, 2018). The staff finds the QA program description acceptable, since it allows implementation of the associated QA program for the design, procurement, fabrication, assembly, testing, modification, maintenance, repair, and use of the Model No. JRF-90Y-950K transportation package.

The staff finds, with reasonable assurance, that the QA program for the JRF-90Y-950K transportation packaging meets the requirements in IAEA SSR-6 (IAEA, 2018) by encompassing the following:

1) design controls,
2) materials and services procurement controls,
3) records and document controls,
4) fabrication controls,
5) nonconformance and corrective actions controls,
6) an audit program, and
7) operations or programs controls, as appropriate.

The staff finds with reasonable assurance that these controls are adequate to ensure that the package will allow safe transport of the radioactive material authorized in this approval.

8.2 Evaluation Findings

Based on review of the statements and representations in the Model No. JRF-90Y-950K package application and as discussed in this SER section, the staff has reasonable assurance that the package meets the requirements in IAEA SSR-6 (IAEA, 2018). The staff recommends revalidation of Japanese Certificate of Competent Authority No. J/2043/B(U)F.

9.0 MAINTENANCE PROGRAM

The evaluation of maintenance activities as these apply to aging management is included in Sections 2.0 and 7.0 of this SER.

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(DOT, 2023b) Boyle, Richard, DOT, letter to Norma Garcia Santos, Storage and Transportation Licensing Branch, NRC, March 2, 2023, ADAMS Package Accession No. ML23058A255.

(DOT, 2023c) Boyle, Richard, DOT, letter to Norma Garcia Santos, Storage and Transportation Licensing Branch, NRC, May 11, 2023, ADAMS Package Accession No. ML23136B145.

(IAEA, 2012) International Atomic Energy Agency (IAEA), SSR-6, “Regulations for the Safe Transport of Radioactive Material,” Revision 1, 2012 Edition, ML22083A077.

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CONCLUSION

Based on the statements and representations contained in the documents referenced above, and the conditions listed above, the staff concludes that the changes to the Model No. JRF-90Y-950K, Japanese Certificate of Competent Authority No. J/2043/B(U)F-96 package, meet the requirements of IAEA SSR-6, 2018 Edition.

Issued with letter to R. Boyle, U. S. Department of Transportation,

On June 23, 2023.